EMSA’s role to enhance; Maritime safety, Maritime security and Environmental protection

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Contents

- EMSA – short introduction
- Maritime challenges – globally
- EMSA maritime data collection & sources
- ABM introduction - Some user cases
- EMSA data users & interagency cooperation
- EMSA data management

EMSA provides European Union (EU) countries and the Commission with technical and scientific assistance to ensure the proper application of EU legislation in the field of maritime safety, security end environmental protection, monitor implementation of EU Directives and evaluate its effectiveness.
EMSA in a nutshell

Regulatory Agency of the European Union

- Own legal identity
  (Regulation (EC) No 1406/2002)

- Maritime safety, security, prevention and response to marine pollution by ships, oil and gas installations

- Technical and operational support to 28 EU Member States and Commission

- Staff ~ 250 people, 25 nationalities

- Annual Budget: ~ 100 million EUR

- HQ Lisbon, Portugal
EMSA activities and tasks

- Accident Investigation
- Ship Safety Standards
- SafeSeaNet
- Environment
- Port State Control
- LRIT
- Equasis - Statistics
- Training - Cooperation
- CleanSeaNet
- Marine Equipment
- Visits - Inspections
- MAR-ICE
Maritime Challenges - globally
Maritime Data Sources

- Synthetic aperture radar
- Long range tracking
- Automatic identification system
- Optical imagery
- Vessel monitoring system
Vessel Position Data: Sources

Messages / Day:
August 31 2017
21,706,047

Individual Ships / Day:
~ 80,000

T- AIS 17,012,200
Sat-AIS 4,585,600
LRIT 31,866
VMS 76,381
Earth Observation Data Available

Optical and Synthetic Aperture Radar (SAR) Missions

Optical Missions:
- SPOT 6/7
- Pleiades 1A/1B
- WorldView-1
- WorldView-2
- WorldView-3
- WorldView-4
- DEIMOS-2
- GeoEye-1

SAR Missions:
- Sentinel-1 A/B
- Radarsat-2
- TERRASAR-X
- TanDEM-X

Service providers:
- CLS
- KSAT
- MDA
- EDISOFT
- EGEOS
- AIRBUS-DS
- EUSI

The CleanSeaNet service relies primarily on SAR data
CleanSeaNet
Integrated data / data fusion

Tailor-made Integrated Maritime Awareness Picture

EXCLUSIVE PICTURE

USER

Mobile data

Local position data

Tailored Ship Register

EMSA

SafeSeaNet

CleanSeaNet

EU LRIT DC

THETIS

/ Vessel Position Data /
(radar, AIS, VMS, on board data)

/ Incidents, sightings or inspections /

/ Domain Specific Ship Register /

/ AIS data /

/ EU LRIT Data /

/ Earth Observation Data /

/ Satellite AIS Data /

/ Vessel information /
Satellite Data Portfolio

**OPTICAL MISSIONS**
- SPOT 6/7
- Pleiades 1A/1B
- WorldView-1
- WorldView-2
- WorldView-3
- WorldView-4
- DEIMOS-2
- GeoEye-1

**SAR MISSIONS**
- Sentinel-1 A/B
- Radarsat-2
- TERRASAR-X
- TanDEM-X

![Graph showing satellite data portfolio with bars for each year from 2012 to 2017, with numbers for each year: 2226, 2547, 3320, 3209, 4575, 395, 847. The bars for 2017 are the highest.](image_url)
Satellite Data: Optical and Synthetic Aperture Radar (SAR) Sensors

Ships?
RPAS Activities

Marine Environment
- Marine Pollution Detection and Monitoring
- Ship Emission Monitoring

Supporting Coast Guard Functions
- EU Border Package: EUR 67 million over 4 years
- Multi-purpose operations
- Supporting Member States in cooperation with FRONTEX & EFCA
EMSA RPAS: Multi-Mission Capability

Detecting of oil spills

Central ground control station

Local ground control station

Communication satellite for BRLOS operations

Fishing vessel

Marine pollution

Air pollution

Irregular migration

RLOS

BRLOS
Integrating Maritime Data

Data becomes “Information”

- Raw position reports – AIS, VMS, LRIT...
- Positions enriched with other operational data
- Multiple Source Positions → Track creation
- Use satellite data & incident information
- Behaviour monitoring

Filtering over large amounts of data. Customization. Summarised reports. Help the operators!
Enrich the maritime picture, detect non-reporting, add operational information
Fill the gaps. Detect erroneous reporting. Investigate history.
Link to other operational information. Remove more inconsistencies.
Data consistency and data gap problems

Integration / Interoperability
Harmonisation
Step 1:
Satellite (SAR) monitoring of Area of Interest
Detection of vessels (Automated)
Vessel Detection & Identification

**Step 1:**
Satellite (SAR) monitoring of Area of Interest

Detection of vessels (Automated)

**Step 2:**
Cross-referencing maritime position data (Automated)

Vessel identification

**Step 3:**
Unidentified Vessel = Target of Interest

- Satellite detected vessels
  - Target cross-referenced
    - Cargo Vessel (AIS)
  - Target cross-referenced
    - Fishing vessel (VMS)

Vessel NOT identified

Target of Interest for further analysis
Services for User Needs and Functions

Automated behaviour Monitoring
+ Alerting to User

ABMs

Maritime Information Services
Automated Behaviour Monitoring

- This algorithm-based system analyses ship positions for the automatic detection of abnormal and specific vessel behavior.
- Users are alerted automatically in real time when certain behaviour is detected.
- A number of algorithms have been developed and can be programmed by the user directly. One thousand alerts are generated daily for different operational functions (safety, security, border protection, fisheries).
How does this work?
ABM is a part of Integrated Maritime Services.

It analyses real time vessel position reports provided for a specific time period and area of interest (AOI), as defined by the users.

The system focuses on the detection of specific events, and therefore may be categorized as ‘event’/‘rule’ based.
ABMs figures

Ref. period: May 2018

13 Member States; 4 EU Bodies

> 70 ABM Admin accounts

230 Running - Active ABMs; other 371 ABMs used

Multiple Distribution lists 88 lists > 212 users

Average 1,000 alerts daily – in SEG; Mobile App and send by email

24 ABM types operational
The IMS WUP allows the display of the ABM related alerting as well as the setting of the new ABMs, for the authorized users.

The IMS Mobile App allows the display of the ABM related alerting.

The ABM related email alerts are sent to the specific users and contain basic information about the detected situation(s).

Frontex – has the M2M interface implemented with the use of OGC standards.
Interfaces available
Automated Behaviour Monitoring

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Security community

Example of ‘at sea encounter’ - two vessels within a close distance
ABM operational use cases (2)

Safety community

Example of a vessel leaving area of interest
Safety community

Distance to shore
less than a defined threshold
Traffic monitoring community

Vessels passing via TSS
ABM operational use cases (5)

Fisheries

Fishing vessel in the area of interest
• In an Age of Big Data, more information is available to us than ever before.

• We can now process, store and share this information at unprecedented volumes in a relatively seamless way.

• The extent to which we can harness this information to enhance maritime surveillance and use modern technology to analyze, link and extract value from big data will play a central role in determining the future of EMSA’s Integrated Maritime Services.

• For this reason, EMSA is investing in cloud-based infrastructure, artificial intelligence and deep learning. This will help to further develop capabilities in the areas of detecting and monitoring vessel behavior patterns, providing risk analysis, and facilitating access to historical aggregated vessel data going back five years and more.

• The features will bring benefits to participating member states and the European Commission as shared efforts and investments pay off by building a clear and comprehensive, common picture encompassing the full range of EU maritime interests.
Interfaces available
Main future developments (1)

- New types of ABMs
- ABMs and the EO data
- ABMs based on the EO imagery and products
- ABM based on statistical data
- SSN EIS data related ABMs
- ABMs using the AIS static data – changes in the identifiers and basic particulars of a ship (ships)
- ABM based on the expanded use of the AIS data
Main future developments (2)

- ABM based on the Satellite AIS (S-AIS) validation
- ABM based on ship reference database (CSD) changes
- ABM based on the regional servers transmitted data
- Additional ‘Event based’ ABMs - line crossing
- ABMs - other data - Reported piracy attack/ incidents
- Detect interlinked situations
- Combining multiple algorithms for the same area of interest and the same vessels of interest
- Combining multiple algorithms via the Administrator console
Services for User Needs and Functions

Maritime Information Services

SEARCH AND RESCUE
National Authorities

OIL POLLUTION MONITORING & DETECTION
National Authorities

VESSEL MONITORING
National Authorities
Services for User Needs and their Functions

Maritime Information Services

- Anti-Piracy
  - EUNAVFOR - Atalanta

- Fisheries Monitoring
  - EFCA

- Maritime Border Control
  - EUNAVFOR - Sophia
  - Frontex

- Narcotics
  - MAOC-N

... other projects

and TRACECA

Safemed Project
CleanSeaNet: Oil Spill Monitoring

Supporting Member States with SAR++
Inter-Agency Cooperation (EUROSUR)

Frontex Fusion Services
Maritime – Environmental – Incident Reporting

EMS-A-Frontex SLA
EU Interagency Cooperation

Existing EMSA systems

Commercial Supplier
5 EMSA services to Frontex under SLA

1. Vessel Monitoring and Tracking
2. Vessel Detection
3. Anomaly Detection
4. Activity Detection
5. Vessel Reporting

Each time a ship enters and leaves the area, an alert will be raised.
EMSA SERVICES TO FRONTEX

VESSELS MONITORING AND TRACKING
- Last vessel positions reported
- Filter options for individual data sources (LRIT, AIS, etc.)
- Historical track for individual vessels

VESSEL DETECTION SERVICE
- Satellite radar detection of vessels over sea areas of interest
- Correlation with vessels tracks
- Highlighting small unidentified boats

ANOMALY DETECTION SERVICE
- Vessel behaviour monitoring
- Alert notifications for suspect behaviour
- Advanced anomaly detection algorithms

ACTIVITY DETECTION SERVICE
- Optical high resolution monitoring
- Activity detection over shore, ports or sea areas

VESEL REPORTING SERVICE
- Regular reporting on vessels of interest
- Intelligence driven approach for monitoring potentially suspicious behaviour

BIG VESSEL CASE SCENARIO
300 GT vessels and above
- Ships reporting position data via LRIT, AIS, etc.
- Monitoring services for cross-border crime (smuggling, migrants, weapons, tobacco, drugs)
- Tracking of particular vessels of interest
- Identifying behavioural patterns of unlawful acts at sea

SMALL VESSEL CASE SCENARIO
15 metres in length and below
- Boats not reporting position data
- Early warning detection service by satellite radar for small unidentified boats at sea
- Follow-up by Member States/Frontex assets for identification and possible search and rescue operations
- Transfer of information in near real time to all operational authorities involved
"All in one" – EMSA services to Frontex

EO Images

Detected vessel positions (VDS)

EO DC
(Earth Observation Data Centre)

Structured Data Exchange

T-AIS
S-AIS
LRIT
VMS

FTP

IMDatE

Ship Positions

"For Frontex Module" at EMSA

Detected objects layers (VDS)

(un)correlated layers (VDS)

Anomalies

VMT Service layers

VDS correlation

ABM

JORA

IMS WUP SEG

Structured Data Exchange
Maritime Analysis & Operation Centre – Narcotics

Support for identification of vessel of interest

- Vessel of Interest was reporting location (satellite AIS) from specific port
- Intelligence information cast doubt on validity
- Optical image requested to verify if vessel was reporting from stated location
- Confirmation received via analysis of optical image

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Anti-Piracy Measures off coast of Somalia

EU Naval Force warships / aircraft patrol to:
• Deter piracy.
• Provide protection to World Food Programme vessels carrying food aid to displaced people in Somalia.

Service Usage:
• Constant/Daily use to track and detect unusual movements

Case study: “ARIS 13” on March 2017
• Movements before and after ARIS 13 was pirated.
• The point at which she was taken can be clearly identified by a sudden change in course.
• Tanker released 4 days later
Data governed by Access Rights & User Profiles

- Access Rights from legislation
- User Profiles by National Competent Authorities
Access Rights Management

“‘You only see what you are entitled to see’”

Maritime Application User
Given the range of data available SELECTING and PRESENTING relevant data in an easy-to-use way is critical

- The right information
- At the right time
- In the right way
Access to Integrated Maritime Services

“SEG”
SafeSeaNet Ecosystem Graphical User Interface

IMS Mobile App
Conclusions

• Multiple maritime challenges to be addressed by governments
• Multiple national authorities in each country
• Multiple data sources…
• Multiple user preferences…

 ✓ Need “Tool Box” solution

 ✓ Data fusion, analysis and availability becomes “Information”

• Common good…common purpose

 ✓ Integrated Maritime Services
Thank you for listening!

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